Shelve in Stacks S.B.T.

7-17

Highway Safety Literature

An Announcement of Recent Acquisitions. . .

HSL No. 71-6
February 12, 1971

THIS ISSUE CONTAINS:
HS-008 513 - HS-008 544
HS-610 428
HS-800 321

U.S. Department of Transportation / National Highway Traffic Safety Administration

HSL No. 71-6 February 12, 1971 HS-008 513 - HS-008 544, HS-610 428, HS-800 321

HIGHWAY SAFETY LITERATURE
AN ANNOUNCEMENT OF RECENT ACQUISITIONS

Published Weekly by the National Highway Traffic Safety Administration
Washington, D.C. 20591

INTRODUCTION

Publications announced in *Highway Safety Literature* include the most recent additions to the collection of the NHTSA Scientific & Technical Information Service. Subject areas covered include all phases of highway, motor vehicle, and traffic safety, especially those encompassed by the National Traffic and Motor Vehicle Safety Act of 1966 and the Highway Safety Act of 1966.

Individual issues of *HSL* are numbered according to the year and the issue number within that year; thus, 71 designates the year and 1, 2, 3, etc. the individual issues. To aid the user in location citations by the HS-number, the cover bears the inclusive entry numbers for each issue.

Entries in *HSL* are arranged according to the revised NHTSA Subject Category List shown in the Table of Contents. The List is a two-level arrangement consisting of five major subject fields subdivided into 58 subject groups. Documents related directly to the National Highway Traffic Safety Administration (NHTSA) are announced in a separate section headed NHTSA DOCUMENTS and are numbered in five distinct series: NHTSA Accident Investigation Reports (HS-600 000 series), NHTSA Compliance Test Reports (HS-610 000 series), NHTSA Contractors Reports (HS-800 000 series), NHTSA Staff Speeches, Papers, etc. (HS-810 000 series), and NHTSA Imprints (HS-820 000 series). For NHTSA DOCUMENTS in series HS-600 000 and HS-610 000, individual full case reports are available for inspection at the National Highway Traffic Safety Administration; or for purchase from NTIS (see page ii). Although announced together in a separate section, these documents are also assigned specific subject categories for machine retrieval.

A document which contains a number of separate articles is announced as a complete volume in the subject category most applicable to it as a whole. Entries for the individual articles appear in their most specific subject category.

SAMPLE ENTRIES

Subject Category Array

NHTSA Accession no..... HS-800 218 Fld. 5/21; 5/9

Title of document..... AN INVESTIGATION OF USED CAR SAFETY STANDARDS--SAFETY INDEX: FINAL REPORT. VOL. 6 - APPENDICES G-L

Personal author(s)..... by E. N. Wells; J. P. Fitzmaurice; C. E. Guilliams; S. R. Kalin; P. D. Williams

Corporate author..... Operations Research, Inc., Silver Spring, Md., O15000 ← For computer use only

Collation

Publication date..... 12 Sep 1969 150p
Contract FH-11-6921
Report no. ORI-TR-553-Vol-6; PB-190 523

Abstract..... Appendices G-L to this study of used car safety standards include: indenture model diagrams for classes I-IV motor trucks; degradation, wear, and failure data for motor truck classes I-IV; and safety index tables for classes I-IV motor trucks.

Search terms: Wear /Trucks; Failures /Trucks; Used cars; Inspection standards /Trucks; Inspection standards /Data

AVAILABILITY: NTIS

HS-004 497 Fld. 5/19

AUTO THEFT—THE PROBLEM AND THE CHALLENGE

by Thomas A. Williams, Sr.

Journal citation . . . Published in *FBI Law Enforcement Bulletin* v37 n12 p15-7 (Dec 1968)

Gives figures on the extent of the auto theft problem and comments on antitheft devices available now or in the planning stage.

Search terms: Theft, Theft protection, Stolen cars

TABLE OF CONTENTS

NOTE: ( ) Numbers in parentheses following certain subject groups indicate the Highway Safety Program Standards (No. 1, and up) and/or Federal Motor Vehicle Safety Standards (No. 101 and up) which may apply to these groups.

NHTSA SUBJECT FIELDS AND GROUPS

NOTE: Material published in Highway Safety Literature (HSL) is intended for the information and assistance of the motor vehicle and highway safety community. While brands names, equipment model names and identification, and companies may be mentioned from time to time, this data is included as an information service. Inclusion of this information in the HSL should not, under any circumstances, be construed as an endorsement or an approval by the National Highway Traffic Safety Administration, Department of Transportation of any particular product, course, or equipment.

Harry A. Feinberg
Managing Editor

U. S. SUPT. OF DOCS.

AVAILABILITY OF DOCUMENTS
AND
INSTRUCTIONS FOR ORDERING

Department of Transportation personnel may borrow copies of publications directly from the NHTSA. Outside the Washington, D.C. area, phone (202) 426-2768. In Washington, D.C. area, use government ID, phone 118-62768. Non-DOT personnel should contact their company or agency libraries for assistance.

Journals cited may be obtained through most research libraries.

Contractors' reports and other documents can usually be obtained as indicated under AVAILABILITY. However, there is no certainty that retention copies will be available for more than a limited period after a document is issued.

The more common distribution sources are identified by symbols which are explained below:

NTIS: National Technical Information Service (formerly Clearinghouse for Federal Scientific and Technical Information–CFSTI), Springfield, Va. 22151. *Order by accession number: HS, AD, or PB.* Prepayment is required by NTIS (CFSTI) coupon (GPO coupons are not acceptable), check, or money order (made payable to the NTIS). *HC* (Paper copy; full size original or reduced facsimile) $3.00 up; *MF* (microfiche approximately 4x6" negative sheet film; reader required) $0.95.

GPO: Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Give corporate author, title, personal author, and report number. Prepayment is required by GPO coupon (NTIS [CFSTI] coupons are not acceptable), check or money order (made payable to the Superintendent of Documents).

HRB: Highway Research Board, National Academy of Sciences, 2101 Constitution Ave., N. W., Washington, D C. 20418.

NHTSA: National Highway Traffic Safety Administration General Services Division, Washington, D.C. 20591 (Telephone (202) 426-0874).

SAE: Society of Automotive Engineers, Dept. HSL, 2 Pennsylvania Plaza, New York, N.Y. 10001. Order by SAE report number. Prices given are list; discounts are available to members and sometimes to libraries and U.S. Government Agencies. Prepayment is required; orders without payment are subject to a $1 handling charge.

IMPORTANT

WHEN REQUESTING a document, to be absolutely sure you receive what you order, give the accession number (HS, PB, AD number) or report number (in cases such as an SAE document), title of report, and the personal or corporate author (whichever is cited). When requesting an HS-numbered document from NTIS (CFSTI), add DOT/ to the prefix HS-; example HS-800 000 should be ordered as DOT/HS-800 000.

SPECIAL NOTICE

NEW PRICES FOR DOCUMENTS AVAILABLE FROM NTIS

On January 1, 1971, the National Technical Information Service (NTIS) increased the prices for documents in certain categories. These increases were made necessary by increased costs. Prices are now as follows:

PAPER COPY

Most documents announced after January 1, 1969, are priced:

1 to 300 pages	$3.00
301 to 600 pages	6.00
601 to 900 pages	9.00
Over 900 pages	Exception Price

Two years after announcement, documents having 300 pages or less will have a service charge of $3.00 added to the announced price. No service charge will be added for documents over 300 pages.

Documents announced prior to January 1, 1969, have a service charge of $3.00 added to the announced price.

MICROFICHE

Microfiche reproduction of documents on a demand basis are priced at 95 cents per document.

Documents available on Standing Order through NTIS Selective Dissemination of Microfiche Service (SDM) are priced at 35 cents per document.

1/0 ACCIDENTS

1/3 Investigation and Records

HS-008 513 Fld. 1/3

CAR COLLISIONS–THE MOVEMENT OF CARS AND THEIR OCCUPANTS IN ACCIDENTS

by G. Grime; I. S. Jones

Institution of Mechanical Engineers, London (England), I35400

1970 41p

The movement of cars impacting obstacles of various kinds and other vehicles has been investigated and in all cases simple mathematical analyses have been found adequate to predict these motions. The obstacles considered were lamp columns, trees, bridge abutments, and walls, impacted at various angles and speeds, and the two vehicle collisions covered a range of weights, velocities, and collision angles representing head on, rear end, and intersection accidents. The movements of the car occupants and their velocities, relative to the car during the most violent phases of impact, are also calculated. The theoretical conclusions are illustrated by examples taken from actual accidents and the relevance of the results to the design of safer cars is considered.

Search terms: Vehicle kinematics / Mathematical analysis; Occupant kinematics /Mathematical analysis; Accident studies /Safety design; Fixed objects /Collisions; Head on collisions; Rear end collisions; Impact angle; Intersection accidents; Vehicle weight /Impacts; Impact velocity

HS-008 514 Fld. 1/3, 5/20

CONTRIBUTING FACTORS STRESSED IN INVESTIGATION OF ACCIDENT

Anonymous

Published in *Transport Topics* n1827 p9 (17 Aug 1970)

The Bureau of Motor Carrier Safety has criticized deficiencies in vehicle maintenance and driver performance which it says together contributed to a rear-end collision between a truck and semi-trailer near Middletown, Connecticut, on February 6, 1970, in which the driver of the second vehicle was killed. "No single clear, undisputed cause for this occurrence can be designated," the BMCS report stated. But the report finally cautioned that, "Neither driver nor vehicle contributions to the accident should be minimized."

Search terms: Bureau of Motor Carrier Safety /Accident reports; Truck accidents /Fatalities; Truck accidents /Connecticut; Accident causes /Truck accidents; Truck maintenance /Accident factors; Truck driver performance /Accident factors; Semitrailers /Truck accidents

1/4 Locations

HS-008 515 Fld. 1/4; 1/3

INVENTORY AND PRIORITIES FOR INVESTIGATION OF HIGH ACCIDENT LOCATIONS FOR URBAN NORTH CAROLINA HIGHWAYS

North Carolina. State Highway Commission, Raleigh, N63400

15 Apr 1968 98p

The inventory report provides, for purposes of investigation only, a list of more than 450 urban intersections identified as hazardous through the analysis of accident data. It is intended that each high accident location be investigated for possible improvement by engineering action. The tables show number of accidents at each intersection studied, the accident rate per motor vehicle entering the intersection, and the severity index derived from a specific formula.

Search terms: Accident location / Highway improvements; Urban intersections /Accident investigation; Urban intersections /Accident rates; Urban intersections /Accident severity; Accident severity index

2/0 HIGHWAY SAFETY

2/5 Lighting

HS-008 516 Fld. 2/5

AIM TO LIVE: A NEW AND VITAL PROGRAM

General Motors Corp., Detroit, Mich., G06600

n.d. 8p

Describes improvements in highway safety after dark and General Motors program to promote safety.

Search terms: General Motors Corp. /Highway safety programs; Headlamp design; Headlamp aiming; Night driving; Night vision

3/0 HUMAN FACTORS

HS-008 517 Fld. 3/0

PSYCHOLOGY AND AUTOMOBILE ENGINEERING. 4. FITTING THE MAN TO THE JOB. APTITUDES FOR SCIENTIFIC CREATIVITY

by M. P. Feldman

Published in *Automobile Engineer* v58 n3 p108-9 (Mar 1968)

Means of identifying and developing the creative worker are discussed. Tests for creativity are mentioned. The personality of the creative person is described. It is suggested that a doctoral degree is not essential in locating creativity in the sense that those who obtain a Ph.D. do not do so by producing profoundly original work, nor may they do so during the rest of their professional careers. Applications to automobile engineering are implied.

Search terms: Administration / Psychological factors; Aptitude / Creativity; Personality /Creativity

HS-008 518 Fld. 3/0

PSYCHOLOGY AND AUTOMOBILE ENGINEERING. 3. FITTING THE MAN TO THE JOB. APTITUDES FOR MANAGEMENT

by M. P. Feldman

3/0 HUMAN FACTORS (Cont'd)

HS-008 518 (Cont'd)

Published in *Automobile Engineer* v58 n2 p56-7 (Feb 1968)

Role playing, the management game, and creativity training known as brainstorming are presented as techniques for management development. The application to automobile engineering is implied.

Search terms: Administration / Psychological factors; Creativity / Administration

3/1 Alcohol

HS-008 519 Fld. 3/1

THE BREATHALYSER–WHAT NEXT?

by T. Garth Waite

Published in *Arrive* n1 p17-9 (Winter, 1st Q 1970)

Any attempt to assess the results of the Road Safety Act 1967 must take into account a variety of statistics. We are told, for instance, that in 1968 (the first calendar year of the breathalyser) the number of convictions of drinking drivers in England and Wales more than doubled as compared with the previous year. In fact, it is now well known that in the first twelve months of the act, a saving of 1,152 lives was reported in addition to a reduction of more than 40,000 casualties. That the breathalyser is worth keeping is not in dispute; but the deterrent effect of the act would be more clearly seen if every driver found to have a blood/alcohol level exceeding the prescribed maximum were convicted and punished.

Search terms: Road Safety Act of 1967 (Great Britain); Breath analysis /Blood alcohol levels; Drinking drivers /England; Drinking drivers / Wales; Accident prevention /Breath analysis

3/7 Drugs Other Than Alcohol

HS-008 520 Fld. 3/7; 3/1

AN EEG STUDY OF THE RELATIONSHIPS BETWEEN BRAIN STRUCTURES IN RABBITS UNDER ETHANOL AND D-AMPHETAMINE

by Robert S. Greenberg; Leonide Goldstein

Published in *Quarterly Journal of Studies on Alcohol* v30 n4 p843-8 (Dec 1969)

13 refs

An EEG study of the relationships between brain structures in rabbits under ethanol and d-amphetamine is reported. The results obtained suggest a possible reason for the contradiction between the situation prevailing at cortical levels as judged by EEG analysis and behavior apparent during ethanol inebriation in animals pretreated with d-amphetamine. Ethanol alone changes the normal relationship of some brain structures without apparently affecting others. Despite the apparent restoration of the EEG patterns of individual structures to control levels, pretreatment with amphetamine does not restore the normal pattern interrelation. Rather it produces further changes in the relationships of structures as evidenced in the case of the hippocampus and the cortex, in which the balance of influence of the two structures as existing under control conditions is reversed.

Search terms: Electroencephalography /Ethanols; Electroencephalography /Amphetamines; Intoxication /Animal experiments; Cerebral cortex /Drugs; Hippocampus /Drugs

3/12 Vision

HS-008 521 Fld. 3/12

SEEING–KEY TO SAFE DRIVING

by John Burke

Published in *California Highway Patrolman* v32 n8 p9, 72-4 (Oct 1968)

A discussion is given of the importance of good vision in safe driving, and the need for drivers' vision requirements. Driving techniques that contribute to better sight, driving hazards, and eye diseases are briefly discussed.

Search terms: Vision /Highway safety; Vision disorders

4/0 OTHER SAFETY-RELATED AREAS

4/7 Mathematical Sciences

HS-008 522 Fld. 4/7; 4/8

AN APPLICATION OF MARGINAL UTILITY TO TRAVEL MODE CHOICE

by Gordon A. Shunk; Richard J. Bouchard

Voorhees (Alan M.) and Associates, Inc., McLean, Va., V18600

1970 17p

Presented at 49th annual meeting of the Highway Research Board, Washington, D. C., Jan 1970.

A mode choice relationship was developed that utilized as its independent decision variable a composite of several more traditional factors. It has been theorized that components of this variable represent the disutilities of travel by competing modes as perceived by the traveler. The final decision variable combined out-of-pocket cost of transit and highway travel, family income, and parking cost as well as travel time for the trip. Mode choice was examined for 1958 data from St. Paul-Minneapolis, using marginal disutility as the independent variable. The results reproduced base-year transit travel patterns very well, without using traditional curve-fitting calibration procedures. The distribution of the results appeared to approximate quite closely the normal. This seems to indicate that the variable used may well approach the actual, though unperceived, variable on which mode choice decisions are based. The technique offers the benefits of conceivably alleviating the need for calibration and offering a more basic, behavioristic formulation that may transcend constraints of transit service levels.

Search terms: Transportation costs /Mathematical models; Transportation /Minneapolis; Transportation /St. Paul; Public transportation; Automobiles; Decision theory

4/8 Transportation Systems

HS-008 523 Fld. 4/8

THE ROLE OF TECHNOLOGY IN DEVELOPING FUTURE TRANSPORTATION SYSTEMS

by John P. Eberhard; Ralph E. Schofer

National Bureau of Standards, Washington, D.C. N10200

1968 4p
Report no. SAE-680165

In addition to rapidly becoming inadequate for growth requirements, the current auto dominant urban transportation technology gives rise to a number of other problems such as mounting toll of auto accidents, air pollution, and scarcity of urban land for highway usage. However, over the past 30 years no new technology has developed which matches the private auto in comfort, convenience, and freedom of movement in transportation. In analyzing transportation, the authors review the technologies of planning, operating, and transportation hardware. Significant recent developments in the functional areas of guideways, vehicles, terminals, command, and control of traffic are discussed. For the future we have to move from transportation systems which follow demand to systems which lead demand. The federal government can encourage technological innovation by sponsoring and coordinating research and disseminating information.

Search terms: Transportation systems; Transportation planning / Federal aid; Transportation planning /Information systems; Transportation planning /Land use

AVAILABILITY: SAE; also in *Analysis and Control of Traffic Flow Symposium*, HS-002 453.

HS-008 524 Fld. 4/8; 4/7

THE PROGRAM BUDGET AND FINANCIAL OPERATING SYSTEMS

by T. E. Stephenson, Jr.

Wisconsin. Dept. of Transportation, Madison, W20100

13 Jan 1970 32p
Report no. SR-10

Presented at 49th annual meeting of the Highway Research Board, Washington, D. C., Jan 1970.

The concepts of the program budget system (PBS) include goal formulation, program definition, selection of program objectives, long-range program planning, management of operation, cost and responsibility control, and appraisal of results. In a broad sense, PBS is intimately associated with every phase of planning and ties the various subsystems together. Instrumental to an effective PBS is a systematic approach to decision-making. PBS is structured to provide the total picture of the resources required, available, and used, and to determine how well the resources were used. It is also useful in conducting current operations and in the appraisal of their results. The data requirements of PBS are merged with the fiscal accounting, personnel, and payroll needs to provide the basic source of financial and budget information for the entire department. Thus, the financial operating system (FOS) becomes the integrated bookkeeping system for management. In performing these business functions, FOS provides the working unit with the two types of data needed: resources (men, money, and materials) and time (process and/or production values). These data are most effectively supplied from the integrated bookkeeping system obtained through the use of electronic data processing.

Search terms: Transportation systems /Transportation planning; Transportation systems /Evaluation; Transportation systems /Costs; Transportation systems /Benefit cost analysis; Transportation systems / Data processing

5/0 VEHICLE SAFETY

5/1 Brake Systems

HS-008 525 Fld. 5/1

DEVELOPING AN ANTILOCK BRAKE SYSTEM

Anonymous

Published in *Autogineer* v25 n4 p4-6 (May 1970)

The announcement by Cadillac and Oldsmobile that antilock brakes will now be available as an option on the Eldorado and the Toronado brings satisfied smiles to the group in A.P.E. that has been researching and testing antilock brake systems. The system Cadillac and Oldsmobile are producing is an electronic system similar to that developed here. Antilock brake systems are referred to by some as antiskid systems, but our engineers feel antilock is a more accurate term because skids can be caused by factors other than locked brakes. Antilock systems aim at giving better stability or control during panic stops by keeping the wheels turning. When front brakes lock, a vehicle no longer responds to steering commands of the driver; when rear brakes lock, the vehicle is unstable. This is dramatically illustrated in movies taken during the E.S. group's test runs.

Search terms: Antilocking devices /Brake systems; Cadillac Eldorado /Antilocking devices; Oldsmobile Toronado /Antilocking devices; Panic stops /Vehicle stability; Panic stops /Vehicle control; Wheel locking /Loss of control

5/2 Buses, School Buses, and Multipurpose Passenger Vehicles

HS-008 526 Fld. 5/2

MINIMUM STANDARDS FOR SCHOOL BUSES. 1964 REVISED ED.

National Commission on Safety Education, Washington, D. C., N14200

1965 101p

Recommendations of National Conference on School Transportation.

School bus standards recommended in this edition continue to be based on safety and economy of pupil transportation. Standards for both the bus chassis and the bus body are detailed. Purchasing specifications including bid proposals are discussed. Relation of school buses to the Uniform Vehicle Code and legislation is presented in the appendix. Also in the appendix are

5/2 Buses, School Buses, and Multipurpose Passenger Vehicles (Cont'd)

HS-008 526 (Cont'd)

formulas, one for determining the electrical load for a typical school bus and one for calculating power and gradeability. Titles and addresses of principal state school officers are listed.

Search terms: School bus safety; School bus standards; School buses /Finance; School bus chassis; School bus bodies; School buses / Uniform Vehicle Code; School buses /Legal factors; Electric systems /School buses; Electric systems /Equations; School bus power / Road grades; School bus power / Equations

AVAILABILITY: National Education Assn. $1.00

HS-008 527 Fld. 5/2; 1/3

INADEQUATE STRUCTURAL ASSEMBLY OF SCHOOLBUS BODIES. THE ACCIDENTS AT DECATUR AND HUNTSVILLE, ALABAMA. SPECIAL STUDY

National Transportation Safety Board, Washington, D. C., Bureau of Surface Transportation Safety, N30050

29 Jul 1970 29p
Report no. NTSB-HSS-70-2

This study reviews the examples of injuries in two school bus accidents, explains how the design of joints and fastenings was involved in the injuries and in structural strength of school buses, and compares school bus construction with construction of other types of buses which employ more efficient and complete fastenings. The study relates entirely to the type of school bus which is manufactured by attaching a school bus body to a truck chassis. Cause of predominating injuries (lacerations) was attributed to inadequate fastening of the roof panels to the bows which permitted separation of the parts exposing sharp edges in one accident. In another accident, the Safety Board concluded that the inadequate or inefficient fastening of structures at the roofline and other locations in the rear contributed to the injuries, one of which was fatal. Cost benefits and priorities are presented. Recommendations are made to the National Education Association and the National Highway Safety Bureau.

Search terms: School bus accidents /Injuries; School bus accidents /Fatalities; Injuries /Body failures; School bus accidents /Structural design; School bus safety / Benefit cost analysis; Case reports / School bus accidents; Joints /School buses; Fasteners /School buses

5/4 Design

HS-008 528 Fld. 5/4

NEW CARS SAFER

by Robert L. Hess

Published in *American Association for Automotive Medicine Quarterly* p17 (Dec 1969)

Dr. Robert L. Hess, director of the Highway Safety Research Institute, reported at the dedication of the institute's building that design improvements in late model automobiles are probably saving 2,500 lives a year. Dr. Hess has scientific evidence for a 5 percent reduction in auto crash fatalities attributable to design improvements in the new cars.

Search terms: Automobile design / Fatalities

5/6 Fuel Systems

HS-008 529 Fld. 5/6

LNG–FUEL FOR THE FUTURE?

by J. M. Stephenson

Published in *Science Journal* v6 p39-44 (Mar 1970)

Liquefied natural gas (LNG) is already common as a convenient way of transporting and storing natural gas. But it has considerable attractions as a fuel in its own right in vehicles ranging from earthmovers to supersonic aircraft.

Search terms: Liquified natural gas /Fuels

HS-008 530 Fld. 5/6

WHERE DOES IT ALL GO?

Published in *Stanford Research Institute Journal* n23 p4-8 (Dec 1968)

A general article on air pollution, discussing a study conducted by Stanford Research Institute. The study tried to determine what happens to air pollutants. Estimates were made of the amount of such things as carbon monoxide and nitrogen oxides discharged to the atmosphere in various ways by automobiles, home furnaces, or power plants. Calculations were made of the amount of the material in the atmosphere. By comparing the two figures it was possible to estimate how effectively nature removes pollutants from the atmosphere.

Search terms: Carbon monoxide; Nitrogen oxides; Air pollution dilution; Air pollutants

HS-008 531 Fld. 5/6

CAN THE CAR FOR POLLUTION?

by D. R. Rowe; L. W. Canter

Published in *Journal of Environmental Health* v32 n4 p413-7 (Jan-Feb 1970)

Sources of air pollution in urban areas have been established, with the various modes of transportation accounting for 59.9 per cent of the total pollutants. Industry contributes 18.7 per cent; generation of electricity, 12.5 per cent; space heating, 6.3 per cent; and refuse disposal, 2.6 per cent. The largest single contributor is the automobile. To understand the contribution of the automobile to the air pollution problem, the best place to start is with the four-stroke internal combustion engine. The authors discuss the working of the ICE, a comparison of automobile and diesel engine exhaust, legislation, reactions of exhaust in the atmosphere, control of exhaust and measuring devices.

Search terms: Internal combustion engines /Air pollution; Air pollution /Urban areas; Power plant air pollution /Urban areas; Diesel engines /Air pollution; Air quality standards; Exhaust emissions /Air pollution control; Measuring instruments /Air pollution control; Industrial air pollution /Urban areas

HS-008 532 Fld. 5/6

GETTING THE LEAD OUT

by Maurice Platt

Published in *Motor* (London) v137 n3540 p23-5 (25 Apr 1970)

After a review of pollution control from automobiles, Platt discusses new standards calling for reduction of nitrogen oxides which will be met by dropping compression ratios and eliminating lead additives from gasoline. Such standards in Europe would pose problems for low powered cars. He proposes caution in eliminating lead and gives two reasons.

Search terms: Air pollution control /Nitrogen oxides; Air pollution control /Exhaust emissions; Compression ratio /Air pollution control; Lead free gasoline /Air pollution control; Air pollution control / Europe; Air quality standards / Exhaust emissions; Air pollutants

5/14 Occupant Protection

HS-008 533 Fld. 5/14

ALL ABOARD THE "MIRACLE" BANDWAGON

Anonymous

Published in *Motor Trend* v22 p8-9 (Aug 1970)

Ready or not, want it or not, there's probably an air bag in your future. It's another rush "miracle" solution that hasn't been perfected or proven, but the government insists that you have it.

Search terms: Air bag restraint systems

HS-008 534 Fld. 5/14

PRELIMINARY RESULTS OF A STUDY OF SEAT RESTRAINT USE AND EFFECTIVENESS IN TRAFFIC ACCIDENTS

Highway Safety Foundation, Mansfield, Ohio, H09800

Oct 1969 15p

The study has achieved its principal objective with respect to passenger car occupants. The relative risk of death has been computed as 4.06 times as great for passenger car occupants not wearing seat belts as for those using seat belts; the relative risk of sustaining either a fatal or severe injury 1.95 times as great. The advantages of seat belt use in preventing serious or fatal injury for front seat occupants has been shown far greater than for rear seat occupants. The advantages of seat belts have been shown for routes having speed limits in the 41-60 mph range. The study has also shown that only 21% of passenger car occupants are using some type of seat restraint. The study illustrates a broad inconsistency between mandatory seat belt installation in new vehicles at a cost of hundreds of millions of dollars and the relatively small advantage that is taken of this investment. This situation should be resolved by state legislatures.

Search terms: Seat belt use; Seat belt use /Seat position; Seat belt use /Consumer acceptance; Seat belts; Seat belt use /Legal factors; Seat belt use /Fatalities; Seat belt use /Injury prevention; Injury statistics /Seat belt use; Seat belt use / Speed limits; Seat belt use /Front seat passengers; Seat belt use /Rear seat passengers; Injury severity /Seat belt use

HS-008 535 Fld. 5/14; 5/4

AUTOMOTIVE INTERIOR ENERGY ABSORPTION

by H. G. Holcomb

General Motors Corp., Detroit, Mich., G06600

1969 14p

Presented before Society of Plastic Engineers, 4 Sep 1967.

The front end and interior crush characteristics of an automobile and their relationship to preventing occupant injury are described in a slide presentation. The study of improvements of energy absorption being done by General Motors is discussed.

Search terms: Occupant protection /Interior design; Energy absorption /Interior design

5/15 Propulsion Systems

HS-008 536 Fld. 5/15; 5/4

ALTERNATIVE NONPOLLUTING POWER SOURCES. E-c ENGINES RATED AVAILABLE NOW. BATTERIES, THEN FUEL CELLS FOLLOW—AN OVERVIEW

by Robert U. Ayres

Published in *SAE Journal* v76 n12 p40-53 (Dec 1968)

An overview of power sources in relation to pollution, efficiency, and costs is presented. It is suggested that internal combustion engines will need to change to fuel injection, improve fuel inlet, provide afterburners, and reduce evaporative emissions from fuel tanks. Costs for these features may be prohibitive. Emission data, costs, maintenance, and performance are tabulated for such external combustion engines as the Otto, Rankine, Wankel, Mallory, and Stirling. Hybrid, battery and fuel cell power plants also are discussed.

Search terms: Air pollution control /Propulsion systems; Internal combustion engines /Costs; External combustion engines /Costs; Internal combustion engines /Emissions; External combustion engines / Emissions; Internal combustion engines /Maintenance; External combustion engines /Maintenance; Internal combustion engines /Performance characteristics; External combustion engines /Performance characteristics; Otto cycle engines; Rankine cycle engines; Wankel engines; Stirling engines; Hybrid powered vehicles; Electric vehicles; Fuel cells

HS-008 537 Fld. 5/15; 5/4

ALTERNATIVE NONPOLLUTING POWER SOURCES. E-c ENGINES AX EMISSIONS. STEAM PROTOTYPES SET FOR 1969—CURRENT RESEARCH INTO E-c ENGINES

by Robert U. Ayres

Published in *SAE Journal* v76 n12 p54-60 (Dec 1968)

Performance and design of steam engines are presented. Details regarding the Williams, Thermo-Electron,

5/15 Propulsion Systems (Cont'd)

HS-008 537 (Cont'd)

Gibbs and Hosick, Pritchard, Keen and Minto are tabulated. A Camaro conversion is also described.

Search terms: Steam automobile design; Steam automobile performance; Lear steam cars; Williams steam cars; Thermo-Electron steam cars; Gibbs and Hosick steam cars; Pritchard steam cars; Keen steam cars; Camaros /Steam automobiles; Minto freon cars; Engine conversion /Camaros

5/18 Steering Control System

HS–008 538 Fld. 5/18

STEERING MECHANISMS

by D. Bastow

Institution of Mechanical Engineers, London (England), I35400

1970 18p

This paper is concerned with the design and construction of the different parts of the steering mechanisms of both private cars and commercial vehicles.

Search terms: Steering systems

5/20 Trucks and Trailers

HS-008 539 Fld. 5/20

PLANNING TO PULL A BOAT TRAILER, EQUIPMENT TRAILER, TRAVEL TRAILER, WITH YOUR NEW CAR?

Chrysler Corp , Detroit, Mich., C42600

1969 4p

Plymouth and Valiant owners are advised of engineering recommendations for occasional, frequent, and heavy duty trailer towing. Optional equipment and trailer weight limits are detailed.

Search terms: Valiants /Towing; Plymouths /Towing; Trailers / Towing; Trailers /Weight limits

5/22 Wheel Systems

HS-008 540 Fld. 5/22

CORRELATION OF HIGH-SPEED PROPERTIES OF FIBERS WITH THE IMPACT PROPERTIES OF TIRES MADE WITH THESE FIBERS

by E. W. Lothrop, Jr.

Published in *Materials Research and Standards* v10 p10-4, 44 (Jun 1970)

Equipment and test methods are described which permit (1) the determination of the stress-strain properties of tire cords at temperatures between 75 and 300 F and at rates of elongation between 1000 and 6000 percent per second and (2) the determination of the plunger breaking energies of passenger tires over the same temperature range at velocities between 60 and 100 mph. Cord and tire properties determined at the high temperatures and deformation rates made available by these new techniques are shown to differ significantly from those determined using standard laboratory test procedures.

Search terms: Tire cord tests / Stress (mechanical); Tire cord tests /Tire temperature; Tire tests / Velocity; Test equipment /Tire tests; Test equipment /Tire cord tests; Tire cord tests /Tensile strength; Tire tests /Deformation

HS-008 541 Fld. 5/22

PHYSICS OF THE SLIPPING WHEEL. III. SLIP UNDER CAMBER AND OTHER FORCES IN PNEUMATIC TIRES

by D. I. Livingston

Published in *Rubber Chemistry and Technology* v43 n5 p981-94 (Sep 1970)

7 refs

Report no. Contribution-452

Presented at a meeting of Div. of Rubber Chemistry, American Chemical Society, Washington, D. C., 5-8 May 1970.

An elementary theory is proposed for the origin of the camber force arising when the plane of a traveling wheel is inclined to the vertical and for its interaction with the lateral slip force when the wheel is at an angle to its traveling direction. The theory considers the path of the periphery of the wheel through the ground contact to be deflected from that taken if the wheel were undeformed, and the resulting tangential stress is summed over the contact area. The results are consistent with experiment for small camber angles.

Search terms: Camber /Pneumatic tires; Tire slip motion; Equations of motion; Lateral force /Pneumatic tires; Physics /Wheels

HS-008 542 Fld. 5/22

PREDICTING TIRE TREAD PERFORMANCE FROM COMPOSITION. I

by J. H. Lane; C. A. McCall; P. F. Gunberg

Published in *Rubber Chemistry and Technology* v43 n5 p1070-81 (Sep 1970)

13 refs

Wet skid resistance of tread compounds, as measured by the British Portable Skid Tester, and heat buildup, as measured by the Goodrich Flexometer, can be predicted accurately from a knowledge of composition and modulus, while wear resistance, as measured by the Pico Abrader, can be predicted with only fair accuracy. The predicting relations were developed using multiple regression analysis from data obtained in a designed experimental program. Independent variables included four polymers, extender level, carbon black N-285 loading, and modulus. Field test results are presented for compounds selected to show improved wet skid resistence while maintaining wear and groove cracking resistance at present day levels. Test conditions influencing tire wet skid testing results, particularly the phenomenon of partial hydroplaning, are discussed.

Search terms: Skid resistance tests /Tire treads; Tire performance /Forecasting; Tire wear resistance /Forecasting; Tire research / Materials tests; Hydroplaning /Inflation pressure; Wet skidding /Skid resistance tests; Tire test equipment; Tire temperature tests

HS-008 543 Fld. 5/22; 5/4

LABORATORY EXPERIMENTS ON REVERTED RUBBER FRICTION

by G. H. Nybakken; R. J. Staples; S. K. Clark

Michigan Univ., Ann Arbor, M36600

Aug 1969 60p 7 refs
Grant NGR-23-005-010
Report no. TR-7; NASA-CR-1398

Laboratory experiments were carried out to explain the mechanism of "reverted rubber" skidding as has been observed on aircraft tires. It was determined that surface heat generation is the cause of this rubber degradation and that such "reverted rubber" exhibits remarkably low friction coefficients on wet surfaces, at all speeds, compared to unreverted rubber on dry surfaces. The process of "reverted rubber" skidding can take place at ambient temperatures, and is not dependent on the simultaneous presence of heat. It is believed to be caused by a thin water film between the soft "reverted" rubber and the rigid roadway.

Search terms: Coefficient of friction /Reverted rubber; Skidding / Reverted rubber; Wet skidding / Reverted rubber; Hydroplaning / Reverted rubber; Skidding /Ambient temperatures; Aircraft tires /Skidding; Pavement skidding characteristics /Runways

AVAILABILITY: NTIS

HS-008 544 Fld. 5/22; 5/4

THE RUBBER JUNGLE

by Paul F. Stoeck

International Harvester Co., Chicago, Ill., 141400

1968 8p
Report no. SAE-680225

Presented at Earthmoving Industry Conference, Central Illinois Section, Peoria, Illinois, 9-10 Apr 1968.

This paper describes the new classification system for elastomer materials (ASTM D 2000-SAE J200). In modern rubber technology it is necessary to list the physical characteristics needed and leave the selection of the elastomer or elastomer blends to the rubber manufacturer. Tables are given to show tensile strength, elongation, heat resistance, oil resistance, and compression.

Search terms: Elastomer specifications; Elastomer classification; Rubber /Physical properties; Elastomers /Tensile strength; Elastomers / Oils; Elastomers /Elasticity; Elastomers /Heat resistance

AVAILABILITY: SAE

NHTSA DOCUMENTS

NHTSA Compliance Test Reports

HS-610 428 Fld. 5/17

SUMMARY OF THE FEDERAL MOTOR VEHICLE SAFETY STANDARDS COMPLIANCE TEST PROGRAM, OCTOBER 1 TO OCTOBER 31, 1970

National Highway Safety Bureau, Washington, D. C., N18000

1970 47p

The individual compliance reports are not being announced in *Highway Safety Literature*, but are available for inspection at the Bureau.

Reports accepted on vehicle standards are: 3 for standard 105 (brake systems), and 3 for regulation 575 (consumer information). Twenty-six investigations are in progress. Reports accepted on equipment standards are: 11 for standard 106 (hydraulic brake hoses), 10 for 108 (lamps, reflective devices), 182 for 109 (new tires), and 4 for 116 (hydraulic brake fluids). Three hundred seven investigations are in progress.

Search terms: Compliance tests / Safety standards; Compliance tests / Federal control; Brake systems / Compliance tests; Consumer information regulations/Compliance; Hydraulic brake hoses /Compliance tests; Lamps /Compliance tests; Reflectors /Compliance tests; Pneumatic tires /Compliance tests; Brake fluids /Compliance tests

AVAILABILITY: NTIS

NHTSA Contractors Reports

HS-800 321 Fld. 5/10; 5/3

DAYTIME MOTORCYCLE HEADLIGHT AND TAILLIGHT OPERATION, FINAL REPORT

by Michael S. Janoff; Arno Cassel; Kenneth S. Fertner; Edward S. Smierciak

Franklin Inst. Research Labs., Philadelphia, Pa., F24000

Aug 1970 214p 37 refs
Contract FH-11-7311
Report no. F-C2588

Executive Summary published in HSL 71-4.

The effect of daytime use of motorcycle headlights and taillights on motorcycle accidents, noticeability, and electrical systems was evaluated. There was a significant decrease in daytime motorcycle accidents in four states with daytime motorcycle headlight laws, giving an annual projected reduction of over 7000 motorcycle accident involvements. Annual economic savings would range from $7.50 to $10.90 per registered motorcycle. Daytime operation of motorcycle headlights significantly increases noticeability, and drivers can positively identify motorcycles sooner and at greater distances. Standard taillights, even modified by intensity, height, number, or contrasting background, do not increase noticeability. Most motorcycles appear to have adequate electrical systems for extended daytime headlight and taillight operation. Increased annual maintenance and repair costs for most motorcycles will be negligible with benefit-to-cost ratios greater than 1.

Search terms: Motorcycle accidents /Headlamp daytime usage; Motorcycle visibility /Headlamp daytime usage; Motorcycle electric systems /Headlamp daytime usage; Benefit cost analysis /Headlamp daytime usage; Headlamp daytime usage /State laws; Motorcycle maintenance costs; Motorcycle electric systems /Evaluation; Headlamp daytime usage /Motorcycle safety; Taillamp daytime usage /Motorcycle safety

AVAILABILITY: NTIS

DOT/HS-800 291

WAVE PHENOMENA IN TIRES

William F. Ames

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July 1, 1970

Final Report

Prepared for

Tire Systems Section
Office of Vehicle Systems Research
NATIONAL BUREAU OF STANDARDS
Washington, D. C. 20234

CST-435

This report was prepared in fulfillment of the National Bureau of Standards Contract CST-435 (funded by the National Highway Traffic Safety Administration through the NBS, Contract FH-11-6090). The opinion, findings, and conclusions expressed in this publication are those of the author and not necessarily those of the National Bureau of Standards nor the National Highway Traffic Safety Administration.

WAVE PHENOMENA IN TIRES

INTRODUCTION

In operation the tire experiences a variety of dynamic processes which are highly undesirable and potentially a threat to vehicle safety. Of all these the study of the traveling wave (sometimes called the standing wave) is the most highly developed, although as yet it is incomplete. Significant portions of the progressive increase in rolling resistance, as velocity increases, is due to the formation of traveling waves near a velocity called the *critical rolling velocity*. Near and above the critical speed a wave is clearly discernible in that portion of the tire which has just left contact with the road (or drum). As the velocity continues to increase the wave magnitude enlarges and the wave deformed area grows until it extends from the tire footprint to as much as one-third to one-half of the tire circumference. Increase in wave magnitude results in increased horsepower consumption and significant tire temperature rise. The value of the critical rolling velocity is inherently related to the structural design, material properties and pressure of the tire.

The purpose of this final report is to briefly summarize our findings from the literature, present simple equations for estimating the critical rolling velocity of each tire and to make recommendations on the future use of this information in the tire safety program.

The summary contained herein is taken from the five interim reports of the present author to the Tire System Section. These reports have either appeared in the open literature or have been accepted for publication. They are:

(1) "On the Longitudinal Wave Propagation on a Traveling Threadline," Developments in Mechanics, Vol. 5, Proceedings of the 11th Midwestern Mechanics Conference, Ames, Iowa, p. 733-746, 1969.
(2) "Waves in Tires," Part I - "Literature Review on Traveling Waves," to appear in Textile Research Journal (June-July 1970).
(3) "Waves in Tires," Part II - "Traveling Wave Analysis," to appear in Textile Research Journal (June-July 1970).
(4) "Discontinuity Formation in Solutions of Homogeneous Nonlinear Hyperbolic Equations Possessing Smooth Initial Data," to appear in the International Journal of Nonlinear Mechanics (1970).
(5) "On Wave Propagation in One Dimensional Rubberlike Materials," to appear in Journal of Mathematical Analysis and Applications (1970).

SUMMARY OF EXPERIMENTAL RESULTS
(See Report No. 3 or Paper No. 2)

A. Gardner and Worswick Experiments - Bias Ply Tires (1951)

(1) Amplitude and circumferential persistence of the waves, for a given tire, increases with increasing load and decreasing inflation pressure. The wave amplitude may be reduced by decreasing tread weight or by increasing the casing stiffness.
(2) The speed at which the waves make their appearance, for a given tire and load, increases with decreasing curvature of the driving drum - that is to say the *minimum* speed for appearance of the waves would be considerably higher on a flat surface than on the drum. *The drum critical speed provides a lower bound* for the road critical speed.

B. Hartley and Turner Experiments - Bias Ply Tires (1956)

(1) Power consumption, or rolling resistance, at high speeds is nearly all due to the traveling wave.
(2) Tire failure, at high speeds, was usually that of tread separation. Separation generally is initiated in the outer layer of the outer ply stocks.
(3) Increase of the critical velocity will provide for lower power consumption and therefore lower operating temperatures. Critical velocity is increased by decreasing mass (less tread thickness), increasing carcass profile, increasing pressure and decreasing crown angle.

C. Powell Experiments - Bias Ply Tires (1957)

(1) Speed at which ripple (traveling wave) begins is controlled by tire design.
(2) Tire life is reduced if ripple severity is more than 1/20 inch.
(3) Ripple increases sharply as speed increases. *It is not possible to drive through to a higher speed where the tire again runs smoothly* (that is this is not a resonance phenomena).
(4) Tire loading has negligible effect on ripple (compare with Gardner and Worswick A(1)).
(5) Increasing inflation pressure delays the onset of ripple. One psi increase in pressure lifts ripple (critical) speed about 2 mph.

D. Biderman - Bias Ply Tires (1961)

(1) The traveling wave increases in amplitude and wave length as speed increases.
(2) In the low speed range, the coefficient of resistance to rolling depends little upon speed but beginning with a specific speed the losses rise quickly.
(3) Mileage of tires to destruction decreases with increased velocity. This destruction is related mainly to temperature increase. As the critical velocity is approached the decrease in life becomes crucial and in the presence of the wave *longevity is measured in moments*!
(4) With increase in velocity of rotation, the contact length increases, the normal pressure distribution in the footprint or contact zone near contact entry increases and near contact exit decreases.

E. Chiesa Experiments - Radial Compared to Bias Ply Experiments (1964-1965)

(1) The radial shows a *smaller absorption of power during rolling, greater structural stability with respect to centrifugal force and a higher critical (traveling wave) velocity* than the bias ply tire.
(2) The radial, partly because of reduced heating, allows *a higher service speed* than the bias ply tire.

Characteristic critical speeds were observed in these experiments as follows:

Author		Tire	Critical Velocity mph
Gardner and Worswick	(1951)	5.75 x 16 four ply	90-100
Hartley and Turner	(1956)	6.00 x 16 four ply	120
Powell	(1957)	not specified	100-140
Biderman	(1961)	7.50 x 16	120-140

SUMMARY OF THEORETICAL RESULTS

Separate treatments are required for the bias ply and radial tires.

A. Critical Velocity Formulas - Bias Ply Tire

If P = pressure, r_1 = meridian radius of curvature, β = cured angle with the circumferential circles and m = mass per unit area of the tire then a *lower bound* on the critical velocity v_{cr} is calculated from

$$v_{cr} = \sqrt{\frac{r_1 P}{m \tan^2 \beta}}$$

Consequently, v_{cr} can be increased by increasing P, increasing r_1 (broader tire), decreasing m (less tread for example) and decreasing β. These results agree with experiment even though they have a theoretical wave mechanics foundation. For example, if we calculate at the crown, let r_1 and P be each increased by 10%, and m decreased by 25% while maintaining the same crown angle, then the critical velocity is *increased* by 27%. Natural wear decreases m and therefore increases v_{cr}. Clearly, tires with little tread are better high speed tires from the wave "point of view."

Equation (1) offers a quick check on the critical velocity but always *underestimates* v_{cr}. *This is then a conservative estimate. The actual values of* v_{cr} *are always higher than this estimate.*

Equation (1) has several limitations. These arise from the lack of incorporation of cord and rubber properties, the omission of stiffness and the actual (but not used) dependence of tire dimensions and radii of curvature upon velocity of rotation. Some of these defects are corrected by the works of Biderman (see our Paper #2) and Ames (our Paper #3). The model used by Biderman limits its utility. He assumed the tire was a plane flexible curvilinear ring having a distributed mass on a continuous base. Shear effects, rubber rigidity and moduli of elasticity are included in a generalization of Equation (1). The *significant dependence* of tire dimensions and cord angle upon velocity of rotation limits the utility of these results.

In our interim report #2 (Paper No. 3) we incorporate cord properties and velocity of rotation effects in our generalization of Equation (1). Because of their complexity both extensions are omitted from this summary.

B. Critical Velocity Formulas - Belted Tires

Bias belted and radial tires exhibit traveling waves at velocities somewhat higher than the bias ply tire. The results of the previous section do not apply since the cord angle β has no meaning for the radial and the belt negates the usefulness of Equation (1) in the bias belted case. Two studies (Hattori [1965] and Böhm [1966] have been carried out for radial tires.

Hattori assumed an elliptical membrane cross-section, and used the known membrane relation $N_\theta = N_\phi \cot^2 \beta$ (N_θ and N_ϕ are the circumferential and meridian stresses) to obtain

$$v_{cr} = \sqrt{\frac{Pr_1}{m} \frac{R_m - (R_m^2 - R_\upsilon^2)/2r_1}{(R_m^2 - R_\upsilon^2)/2R_m}}$$

Here R_m = maximum tire carcass radius and R_υ = radius of maximum width.

Böhm employs a prestressed elastic ring on an elastic foundation as a model of the radial tire. Thus he visualizes the belt as a relatively flexible ring which is elastically supported on the flexible reinforced membrane. Upon omission of bending stiffness, which he asserts has only a slight effect, he finds that

$$v_{cr} = \sqrt{\frac{T_o}{\rho a^2}}$$

where a is the maximum tire radius, ρ is mass per unit length of the belt and T_o is the circumferential stress in the belt.

Böhm's result is oversimplified and the present author favors the use of Equation (2) as an estimator of the critical velocity since it incorporates basic physical parameters and is easily computed from available data. Neglecting bending, as it does, it will usually slightly overestimate the critical velocity.

RECOMMENDATIONS

A. All tires should be critical speed rated.

In some of the aforementioned experimental work critical speeds of 100 miles per hour were observed under standard situations (rated load, rated pressure, etc.). If that tire is of bias ply construction and the pressure is allowed to fall to 1/2 of the rated value the critical velocity will fall to approximately 71 miles per hour! This is well within present interstate speed limits. The problem is less severe for bias belted and radial tires.

B. Minimum critical speed ratings should be set for tires marketed for highway use.
C. The establishment of speed limits should include considerations of the minimum critical speed ratings of B.
D. Truck and bus tire critical speed ratings should be carefully studied in another project.

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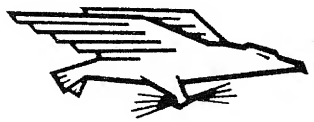

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